Using "Pasco Capstone" for Data Collection and Analysis

Bring a flash drive (usb stick) so you can back up the hard drive save.

"Tracker" is another program that can analyze videos if capstone doesn't run.

1. Download and install the program "Pasco Capstone" at:
   http://www.pasco.com/family/pasco-capstone/index.cfm
   (it requires Windows XP SP2 or higher or Mac OS X v10.6 or higher)

Our site license key: 18tmi-qg1n1-0p1v0-ohid9-g0ome-c891l

2. Choose a display. If you are using a webcam or prepared movie, drag the movie icon from the right bar to the screen. If you are using a sensor, drag the graph.

For movie creation using a connected camera:

1. Click on record movie with synced data. You should see a preview from your camera. If there is no image, click on "hardware setup" and "add sensor/instrument". If the image is static, click the red circle at the top of the image to preview. Mouse over the image to see the toolbar.
   If there is a qucktime error, you need to download quicktime and enable java in the installation (disabled on default). As of 2016, Apple doesn't support quicktime for windows anymore, so this can be a security exploit. Make sure it is not enabled for your web browser (shouldn't be by default).
2. Set up your apparatus so that the full range of motion of the object is visible. Include a known length, a metre stick for example, in the video. You can enlarge the image if you want by dragging the corners. A plumb line is good to include to set the verticle axis.
3. You can adjust the frame rate at the bottom of the screen or under "Harware Setup" you can adjust the resolution as well. If the movie timing is off (windows XP?), you can right click on the movie and select "properties" and "movie playback". Set the timing to 15 Hz for webcams should work.
4. Click on the red dot labeled "Record" and click again to stop when you are done.
5. If the movie looks good, click "File" and "Save as" using your name. If you don't like it, click "Delete Last Run" at the bottom right. Save a copy on a usb stick.

Once you have a movie to analyze:

1. Capstone reads .avi, .mov and .mp4 formats.
2. If you are using an unsynched movie, you will have to check that the framerate of the playback corresponds with the collection rate. If the timing seems off, you can right click on the movie and select "properties" and "movie playback", then change the framerate.
3. The top left button above the movie is a "+". Click on that button to analyze the motion of the objects in the movie.
4. To set the scale, click on one end of the yellow calibration tool and drag it to one end of your metre stick or know length. Repeat with the other end. If the known length is not 1 metre, right click on "calibration tool" and select "properties", then input the length. You can match the y axis to your plumb line.
5. Use the slider beside the record button to find the point in the movie you want to start data collection. For example, when the projectile leaves your hand.

6. Use the left mouse button to click on an object in the movie. Record on a piece of paper how much uncertainty there is in your measurement of position. When you move the mouse slightly, how much does the position change?
7. Keep left clicking on some point on the object until you have the data you want. If there is a second object, click on "create tracked object".
8. See the next page for analysis instructions.

Using a sensor: (position, force, temperature, PH, light)

1. Drag the graph icon from the right onto the screen. Click on "select measurement" and choose the data you want to see, like "motion sensor – position(m)". If you don't see your sensor, check the usb connection.
2. Choose sampling rate and zero where you want the value to be zero. Click on "Record" to start and stop sampling data.
3. Click "File" and "save as" after each data set.
4. Repeat for multiple sets of data. Click on the rainbow triangle to select which run to display. Click the arrow beside "delete last run" to select data to delete. Watch that you don't click "delete all". If you do delete accidentally, click "file" and "load" to get your last save.

Analyzing completed data using Capstone:

1. If you are not using all the data you selected, click on the button with a yellow pen and blue dots, "highlight range of points in active data". Select the portion of the data set you want to use to determine the equation.
2. Find a button with blue dots and the red line, "curve fits". Click on the arrow beside it and select the curve corresponding to your data. Usually it will be "linear" or "quadratic" or "inverse". You should get a best fit line and the line variables in a box.
3. Click on the red "A" to annotate the graph. Type in the equation for the data from the information given from step 1. For example: if your data is position-time and linear with slope 2.49 +/- 0.54 and y-intercept -3.30 +/- 0.82 write out the equation " d = 2.5 m/s t -3.3m" – round to the precision of the uncertainty. IB students should include the uncertainty to 1 sig fig so it is "d = 2.5 +/-0.5m/s t – 3.3+/-0.8m"
4. Click "File" and "save" or hit the save button.
5. Click on the blue gear "properties" and "active data appearance" scroll down and click "show x error bars" and "show y error bars" then "set fixed range" and specify the amount depending on the uncertainty of your measuring method.
6. Click "File" and "print preview". If you used a movie, have the screenshot of your movie with the points along with the graph or do each as a separate page. Check if "landscape" printing gives a better printout.
7. If it looks good, print or do a screenshot by clicking "alt- printscreen" for PCs.
8. Pull a table onto the screen and click on "select measurement"
9. The top, left button above the table adds another column.
10. If the label needs to be altered, left click on the column label and click "rename". IB students need to add uncertainty to the table for complete marks.

11. Once you have all the data displayed, Click “File” and “print preview”. Print the first page of your data tables. I don’t want multiple pages of data, I just need the first page. Alternately, you can right click on the corner of the data and copy and paste it into your report. If you want to analyze the data with another program (like a spreadsheet or Mathcad), you can use “File” and “export” to create a text file of the data.

Good luck!